

than 5000 lb. per square inch. The thickness of the links is about  $\frac{1}{4}$  of their depth. The diameter of the eccentric rod gudgeons may be about  $\frac{1}{2}$  of the depth of the quadrant bar, and the diameter of the drag link pins may be 0.7 of this diameter.

The stress on the valve-rod screw may be 5000 lb. per square inch and 2800 to 3000 lb. per square inch in the body. The diameter of the part passing through the stuffing-box is sometimes half the diameter of the piston-rod +  $\frac{1}{4}$  in. The stress on the valve-gear bolts may be 4000 to 4500 lb. per square inch. The bearing pressure on the valve-spindle eye may be from 600 to 700 lb. per square inch, and on the eccentric-rod pins from 700 to 850 lb. per square inch. All the stresses and bearing pressures are computed on the load on the low-pressure valve given above.

Pistons.—Pistons are usually made of cast iron of heavy box-section, but low-pressure pistons and those for the second medium-pressure cylinders

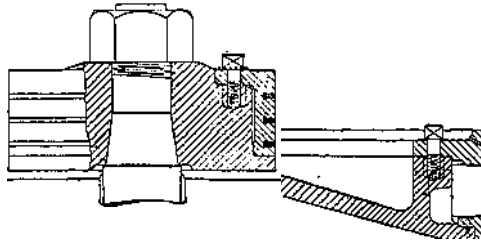


Fig. 33.—Typical Piston Packing Rings and Methods of Fastening in Marine Practice

of quadruple engines may be made of cast steel, or sometimes of forged steel. The high-pressure piston for small cylinders is often solid. Various types of packing rings are used, but the simplest and on the whole the most satisfactory is a plain Ramsbottom ring of narrow face and rectangular section, which will not wear the cylinder. The rings are turned to a diameter of about  $\frac{1}{16}$  in. larger than the bore of the cylinder for each  $\frac{1}{2}$  in. diameter. They are then cut and compressed until the joint is open about  $\frac{1}{16}$  in., and are then turned to fit the cylinder bore. The axial thickness of the rings may be  $\frac{1}{8}$  in. for the high-pressure cylinder to  $\frac{1}{4}$  in. for the low-pressure cylinder, three rings being used for each piston. The radial depth of the

rings may be from i to if in. The rings are inserted in a separate carrier which can be withdrawn for examination independently of the piston. This is secured to the piston body by steel screws with square heads screwing into gun-metal nuts, which are themselves screwed into the piston body. An example of this construction is shown in fig. 33. Brass washers are placed underneath the heads of the screws. In many cases the piston rings are made by firms who manufacture them as specialities. The restrained type of ring is often used for high-pressure cylinders. They are always fixed in a carrier ring.

It is not easy to apply calculations for the strength of pistons to such a structure as a hollow box-section, and the only guide is experience.